



Introduction to Mediatek QoS

2013/7/16



Outline

- Overview of QoS Web UI
- SW QoS (TC, traffic control)
 - DRR
 - SPQ
 - Mixed
 - Fairness QoS
- HW QoS (QDMA, MT7621)
 - Replace DRR
 - Replace SPQ
 - Replace Mixed
- Test Result

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Mediatek QoS Web UI

QoS Setup			
Quality of Service	Bi-direction <input type="button" value="v"/>		
Upload Bandwidth:	50M <input type="button" value="v"/>	Bits/sec	
Download Bandwidth:	50M <input type="button" value="v"/>	Bits/sec	
QoS Model:	DRR <input type="button" value="v"/>		
Reserved bandwidth:	0% <input type="button" value="v"/> (10% is recommended)		

QoS Upload Group Settings			
Highest	Rate: 40% <input type="button" value="v"/>	Ceil: 100% <input type="button" value="v"/>	
High	Rate: 30% <input type="button" value="v"/>	Ceil: 100% <input type="button" value="v"/>	
Default	Rate: 20% <input type="button" value="v"/>	Ceil: 100% <input type="button" value="v"/>	
Low	Rate: 10% <input type="button" value="v"/>	Ceil: 100% <input type="button" value="v"/>	

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High	Rate: 30% <input type="button" value="v"/>	Ceil: 100% <input type="button" value="v"/>	
Default	Rate: 20% <input type="button" value="v"/>	Ceil: 100% <input type="button" value="v"/>	

QoS Upload Rule Settings			
No	Name	Group	Info.
1 <input type="checkbox"/>	HTTP	Highest	Protocol: Application Application: http
2 <input type="checkbox"/>	FTP	High	Protocol: Application Application: ftp
3 <input type="checkbox"/>	Samba	Default	Protocol: Application Application: smb

Classifier Settings	
Direction	Upload <input type="button" value="v"/>
Name	HTTP <input type="button" value="v"/>
Group	Highest <input type="button" value="v"/>
MAC Address	<input type="text"/>
Dest. IP address	<input type="text"/>
Src. IP address	<input type="text"/>
Packet Length	<input type="text"/> - <input type="text"/> (ex: 0-128 for small packets)
DSCP	<input type="button" value="v"/>
Protocol	Application <input type="button" value="v"/>
Application	<div> Chikka Soribada Armagetron Advanced Biff HL1, Quake, CS Shoutcast and Icecast NetBIOS hddtemp POP3 live365 VNC Gkrellm ZMAAP Finger HTTP HyperText Transfer Protocol - RFC 2616 </div>
Remark DSCP as:	Not change <input type="button" value="v"/>

Mediatek QoS Web UI

Classifier Settings	
Direction	Upload
Name	HTTP
Group	Highest
MAC Address	
Dest. IP address	
Src. IP address	
Packet Length	- (ex: 0-128 for small packets)
DSCP	
Protocol	Application
Application	<div> Chikka Soribada Armagetron Advanced Biff HL1, Quake, CS Shoutcast and Icecast NetBIOS hddtemp POP3 live365 VNC Gkrellm ZMAAP Finger HTTP HyperText Transfer Protocol - RFC 2616 </div>
Remark DSCP as:	Not change

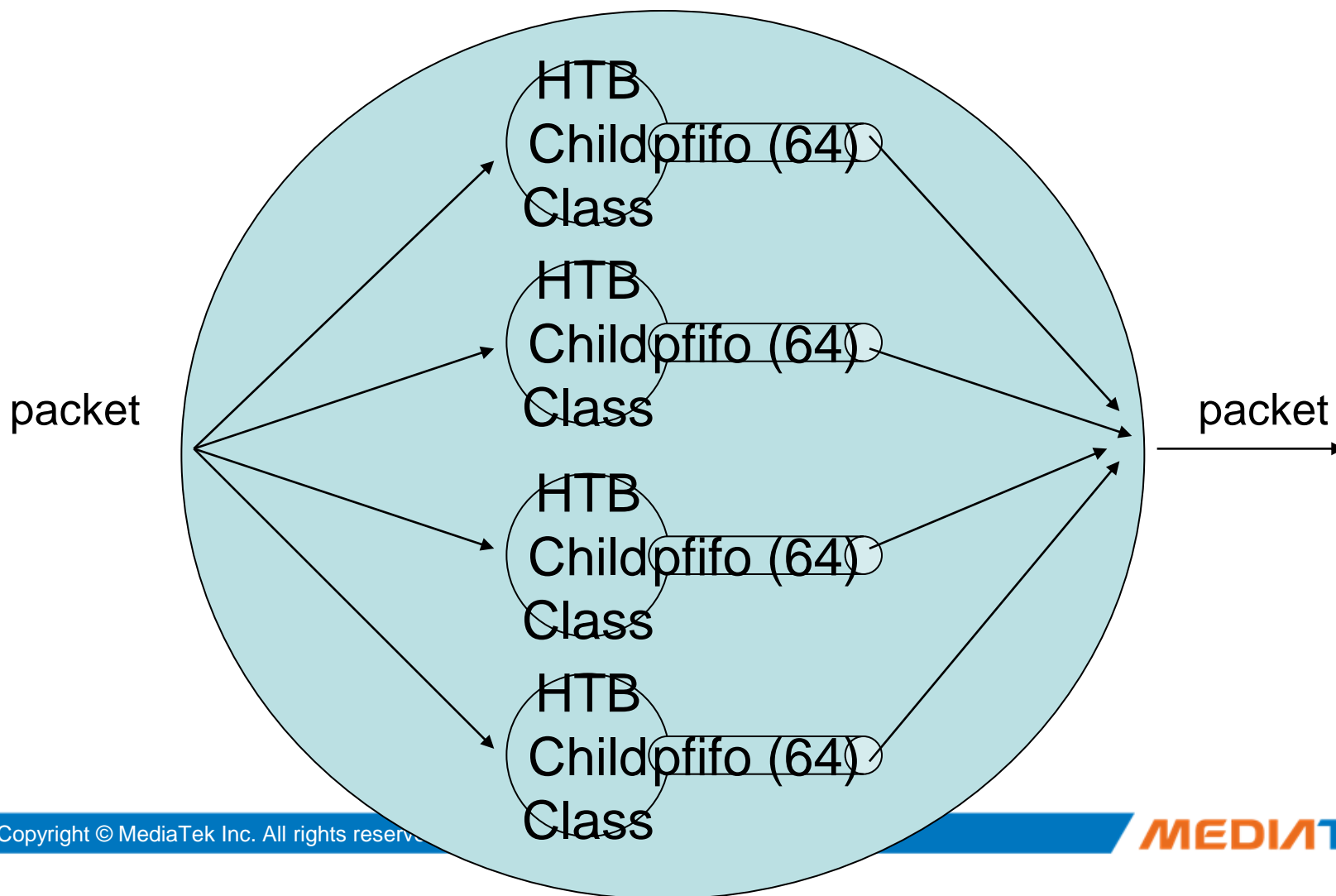
Mediatek SW QoS supports these classifiers currently:

- a) SRC/DSP IP address (with netmask)
- b) Packet length
- c) DSCP field
- d) ICMP, TCP/UDP port range
- e) Layer 7 (content inspection)

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QoS Model : DRR(HTB, Rate limited)



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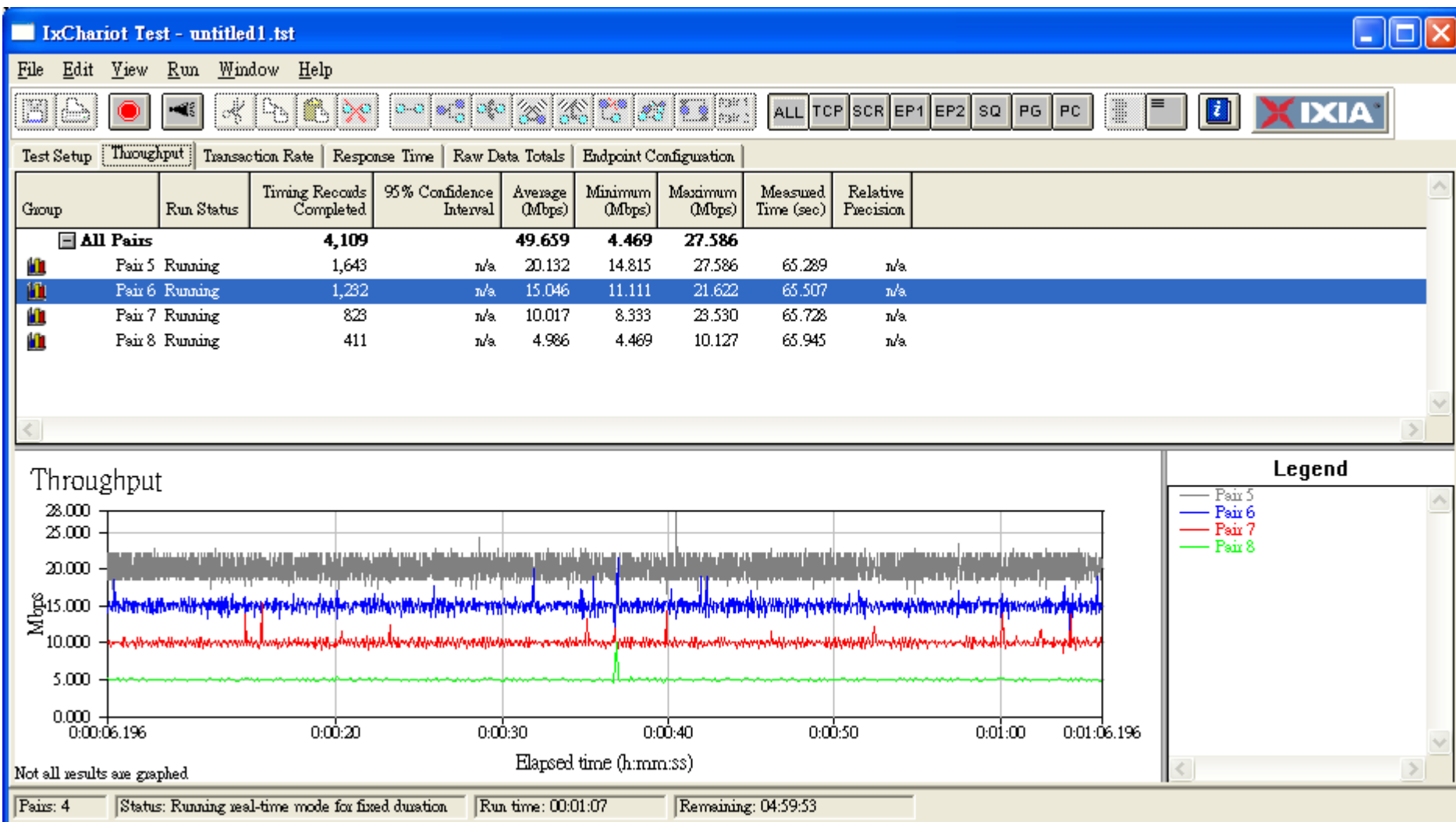
Four QoS groups are shown after specifying Global settings in Ralink SW QoS. Now all packets through this gateway are classified into these four QoS groups according to the user's QoS rules settings. The four QoS groups are subsequently shown.

Quality of Service Settings

You may setup rules to provide Quality of Service guarantees for specific applications.

QoS Setup	
Quality of Service	Download from Internet ▼
Upload Bandwidth:	32M ▼ Bits/sec
Download Bandwidth:	32M ▼ Bits/sec
QoS Model:	DRR ▼
Reserved bandwidth:	0% ▼ (10% is recommended)
QoS Download Settings	
Highest	Rate: 10% ▼ Ceil: 100% ▼
High 4 groups	Rate: 10% ▼ Ceil: 100% ▼
Default	Rate: 10% ▼ Ceil: 100% ▼
Low	Rate: 10% ▼ Ceil: 100% ▼
Submit	

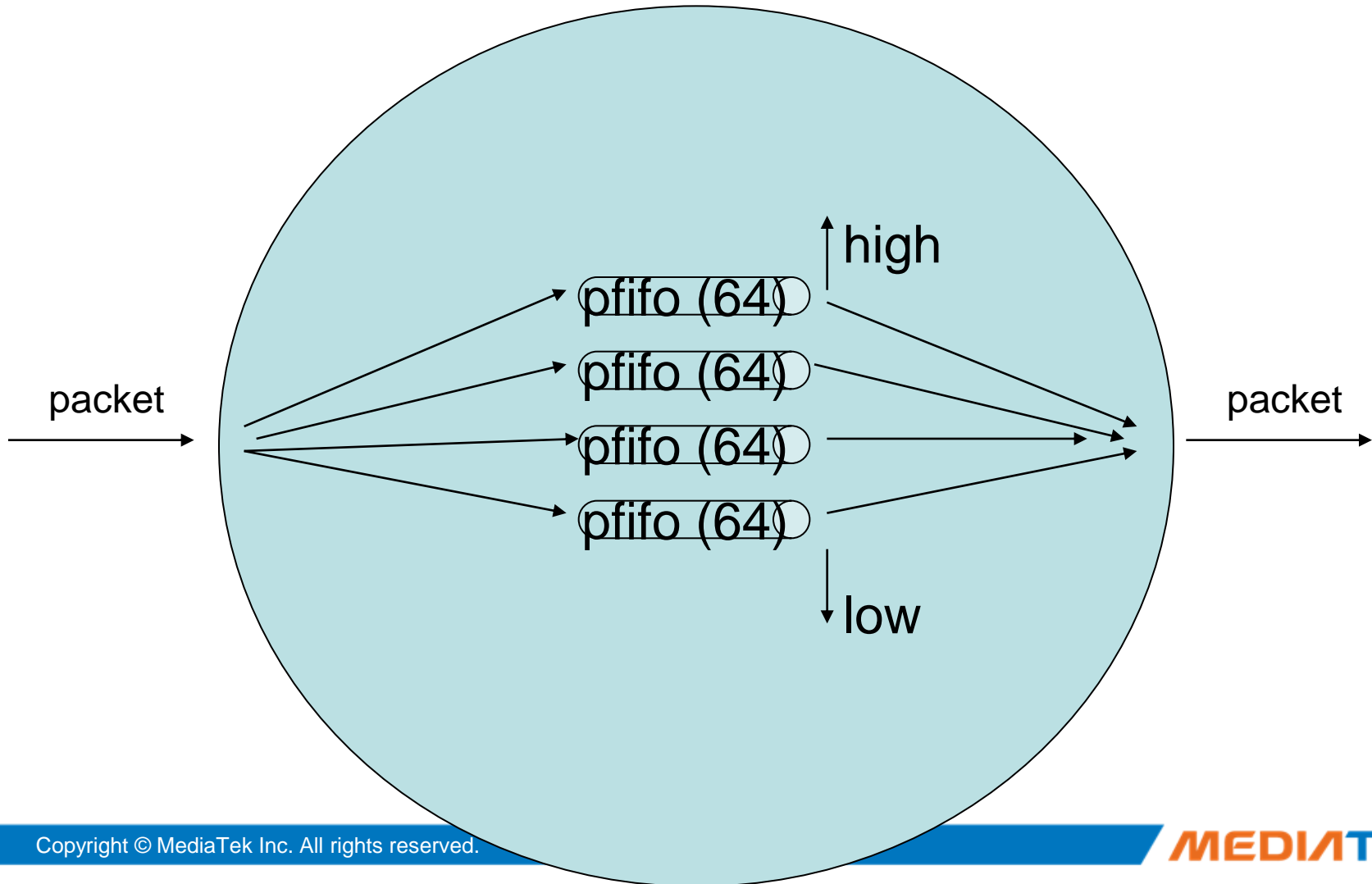
QoS Model : DRR(HTB, Rate limited)



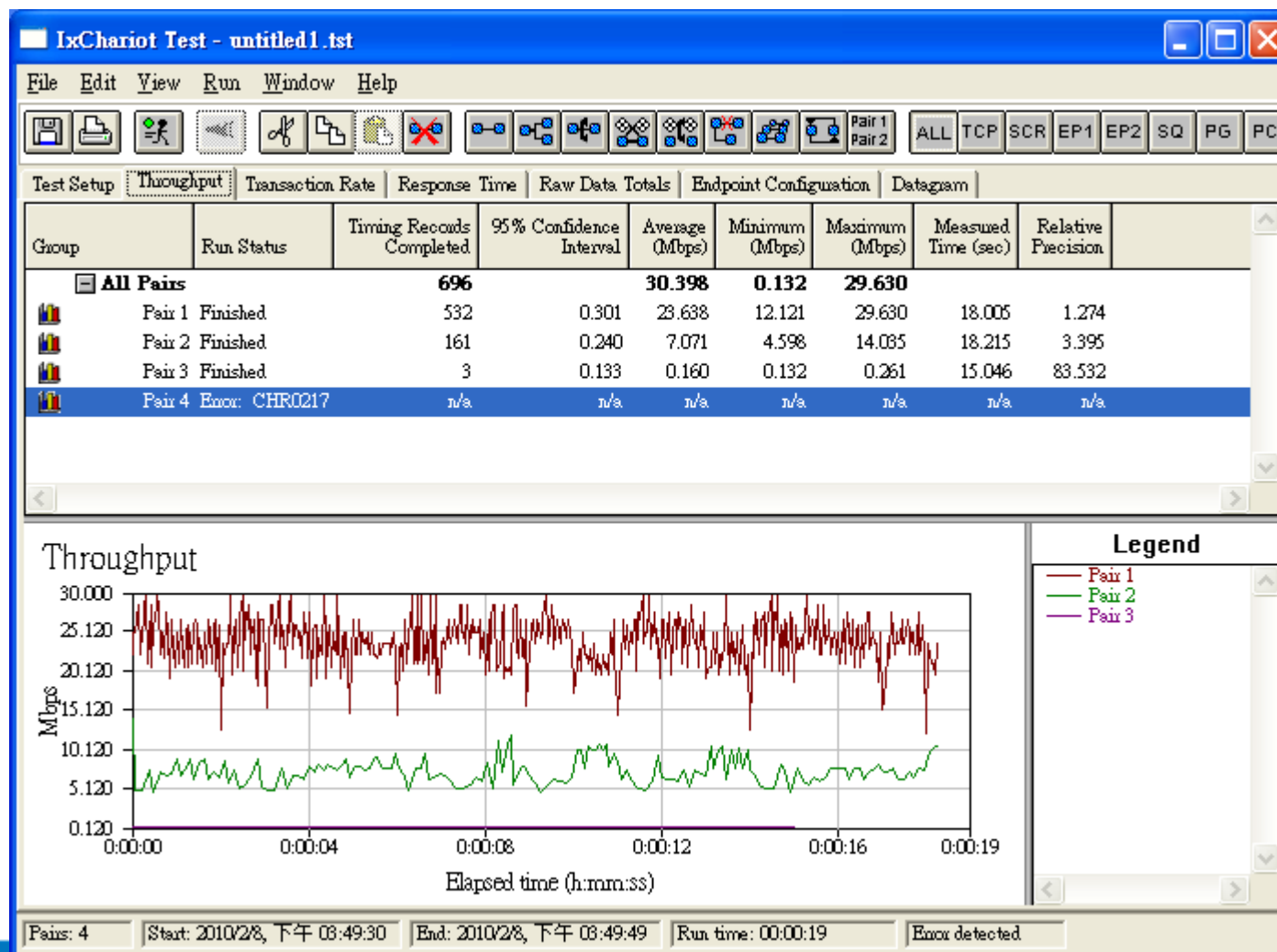
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QoS Model : SPQ(PRIO, Priority schedule)



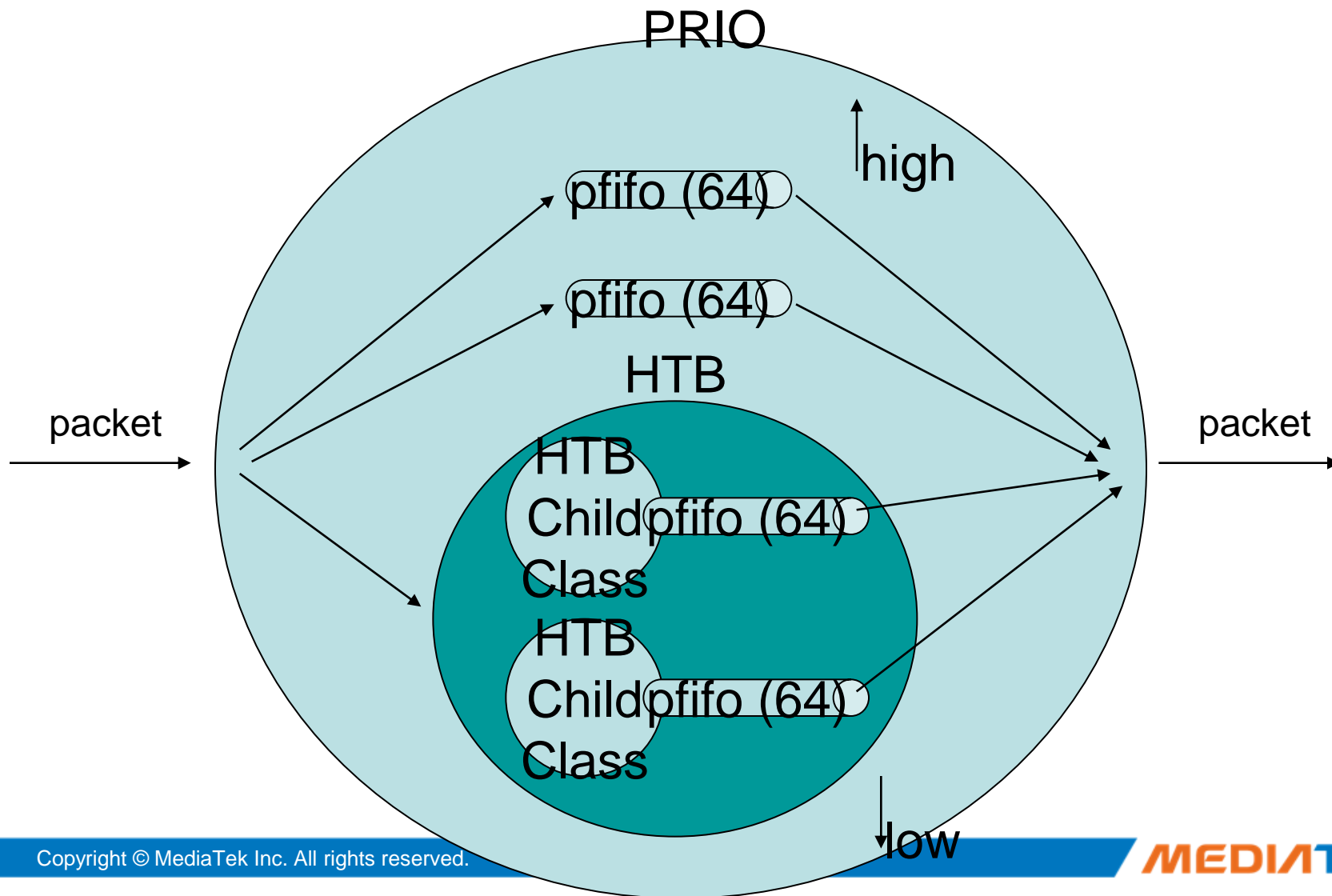
SPQ (Priority, upload, UDP)



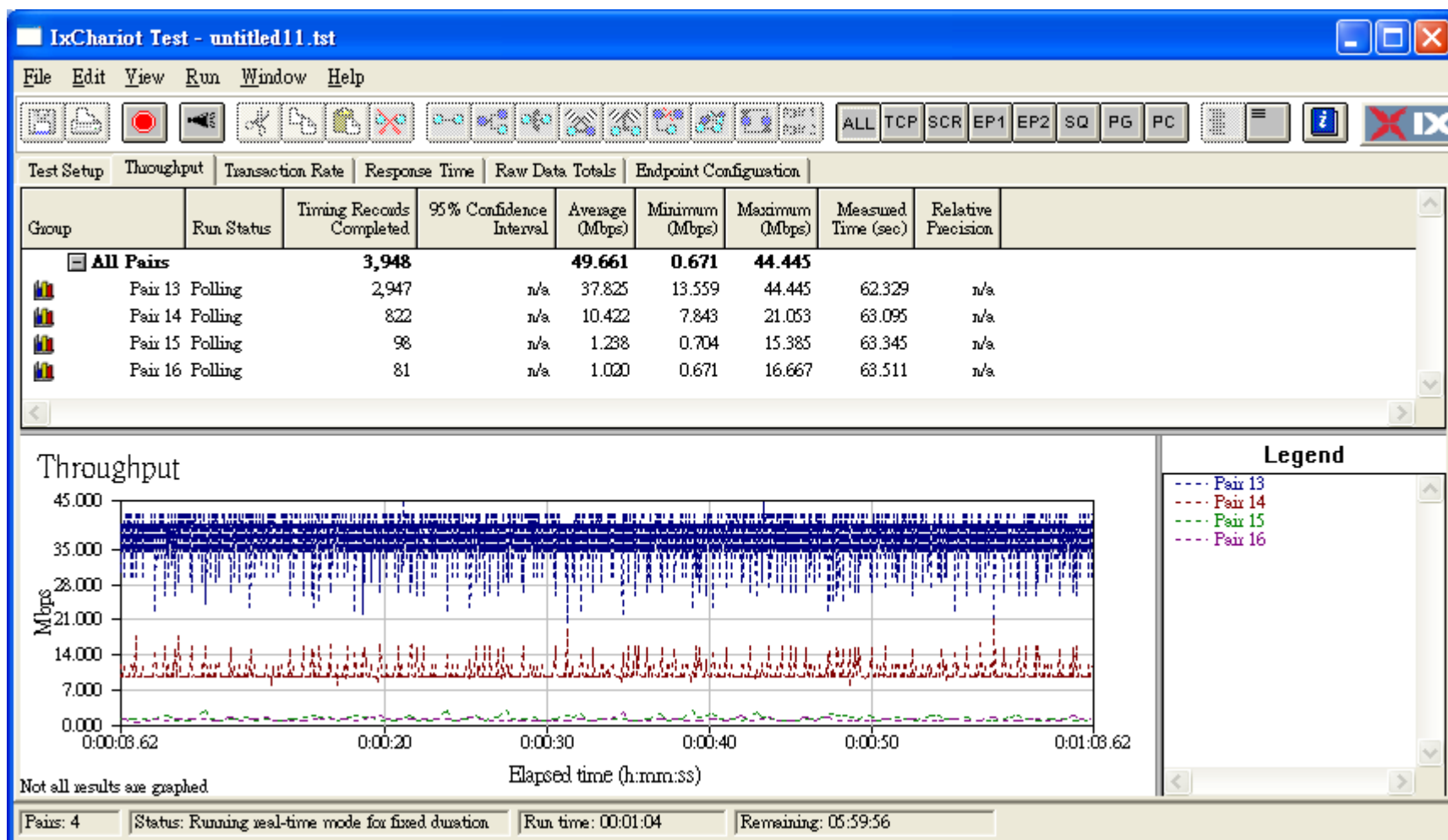
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QoS Model : Mixed(SPQ+HTB)



QoS Model : Mixed(SPQ+HTB)



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QoS Model : fairness QoS

QoS Setup	
Quality of Service	Upload to Internet ▼
Upload Bandwidth:	50M ▼ Bits/sec
Download Bandwidth:	50M ▼ Bits/sec
QoS Model:	Fairness QoS ▼
Reserved bandwidth:	0% ▼ (10% is recommended)

Fairness QoS does not shape traffic but only schedules the transmission of packets, based on 'flows'. The goal is to ensure fairness so that each flow is able to send data in turn, thus preventing any single flow from drowning out the rest.

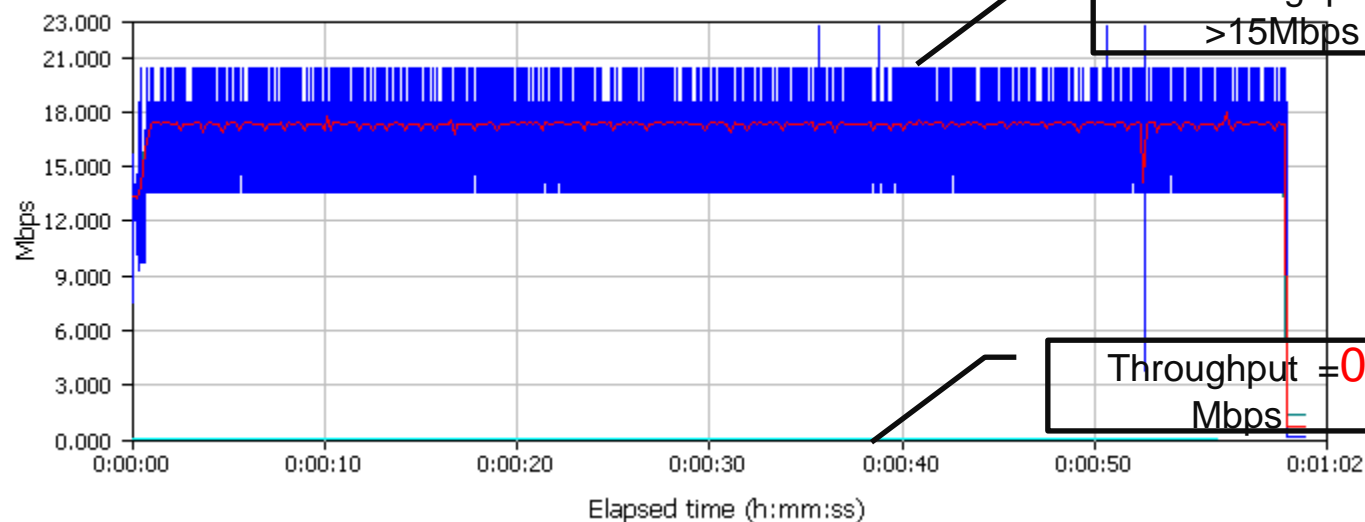
QoS Model : fairness QoS

Test condition: 9 pair

Group	Run Status	Timing Records Completed	Endpoint 1	Endpoint 2	Network Protocol	Service Quality	Script/Stream Filename
All Pairs		4,426					
	Pair 4 Finished: Warning(s)	135	10.10.10.3	10.10.20.13	RTP		IPTVv.scr
	Pair 5 Finished	414	10.10.10.3	10.10.20.13	TCP		Filesndl.scr
	Pair 6 Finished: Warning(s)	1,917	10.10.10.3	10.10.20.13	RTP		IPTVa.scr
	Pair 7 Finished	136	10.10.10.3	10.10.20.13	UDP		IPTVv.scr
	Pair 8 Finished	314	10.10.10.3	10.10.20.13	TCP		Filesndl.scr
	Pair 9 Finished	351	10.10.10.3	10.10.20.13	TCP		Filesndl.scr
	Pair 10 Finished	359	10.10.10.3	10.10.20.13	TCP		Filesndl.scr
	Pair 11 Finished	407	10.10.10.3	10.10.20.13	TCP		Filesndl.scr
	Pair 12 Finished	393	10.10.10.3	10.10.20.13	TCP		Filesndl.scr

No fairness QoS

Throughput



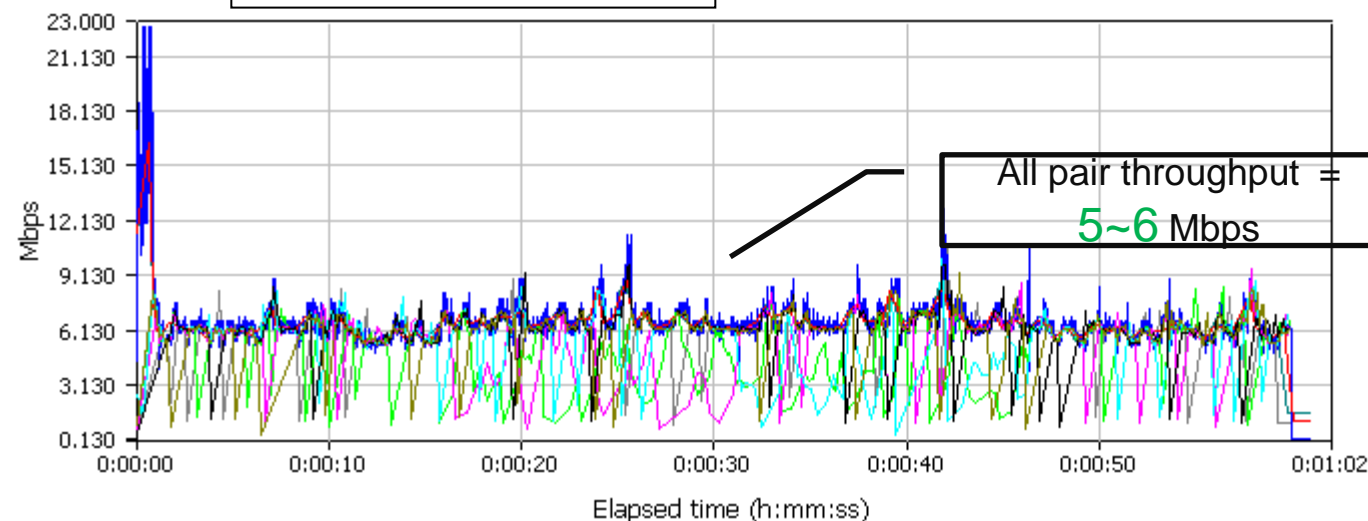
Legend

Pair 4
Pair 5
Pair 6
Pair 7
Pair 8
Pair 9
Pair 10
Pair 11
Pair 12

Not fair

fairness QoS

Throughput



Legend

Pair 4
Pair 5
Pair 6
Pair 7
Pair 8
Pair 9
Pair 10
Pair 11
Pair 12

Almost fairness

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How to Classify Packets

- We want to set these four priority.

VI = min 50Mbps, max = unlimited (Highest)

VO = min 20Mbps, max = unlimited(High)

BK = min 5Mbps, max = unlimited(Default)

BG = min 1Mbps, max = unlimited (Low)

- We can use DSCP value as classify rule.

DS5 (P2)	DS4 (P1)	DS3 (P0)	DS2	DS1	DS0	ECN	ECN
-------------	-------------	-------------	-----	-----	-----	-----	-----

P2	P1	P0	802.1D	AC
0	0	0	0	BE
0	0	1	1	BK
0	1	0	2	BK
0	1	1	3	BE
1	0	0	4	VI
1	0	1	5	VI
1	1	0	6	VO
1	1	1	7	VO

CS1

CS2

CS3

CS4

CS5

CS6

CS7

```
iptables -t mangle -A qos_prerouting_rule_chain -m dscp --dscp-class CS4 -j MARK --set-mark 52 (VI)
iptables -t mangle -A qos_prerouting_rule_chain -m dscp --dscp-class CS6 -j MARK --set-mark 22 (VO)
iptables -t mangle -A qos_prerouting_rule_chain -m dscp --dscp-class BE -j MARK --set-mark 62 (BE)
iptables -t mangle -A qos_prerouting_rule_chain -m dscp --dscp-class CS2 -j MARK --set-mark 12 (BK)
```

Highest Priority → set mark 52

High Priority → set mark 22

Default Priority → set mark 62

Low Priority → set mark 12

After classify



QDMA do dequeue

HW QoS (QDMA) replace DRR

- QDMA replace HTB (TC function)
 - Minimum Rate
 - Maximum Rate

QoS Setup	
Quality of Service	Upload to Internet ▾
Upload Bandwidth:	50M ▾ Bits/sec
Download Bandwidth:	50M ▾ Bits/sec
QoS Model:	DRR ▾
Reserved bandwidth:	0% ▾ (10% is recommended)
QoS Upload Group Settings	
Highest	Rate: 40% ▾ Ceil: 100% ▾
High	Rate: 30% ▾ Ceil: 100% ▾
Default	Rate: 20% ▾ Ceil: 100% ▾
Low	Rate: 10% ▾ Ceil: 100% ▾

HTB Example:

Minimum
Rate

Maximum
Rate

```
tc class add dev imq0 parent 3:0 classid
3:1 htb rate 1024kbit ceil 2048kbit
```

QDMA Example:

Minimum
Rate

Maximum
Rate

```
qdma rate 10 1 1024 1 2048
```

Usage:

```
qdma rate [queue] [min_en] [min_rate] [max_en] [max_rate]
- set rate control for queue
```

HW QoS (QDMA) replace DRR

- classify packet + QDMA → classify packet + dequeue

qdma sch_rate 0 1 51200 (total BW = 51200kbyte)

qdma resv 2 50 50

qdma sch 2 0

qdma rate 2 1 5120 1 51200 (min rate=5120kbyte, max rate=5120kbyte)

qdma m2q 11 2 (set queue mapping: skb with mark 11 to queue 2.)

qdma resv 3 50 50

qdma sch 3 0

qdma rate 3 1 10240 1 51200

qdma m2q 61 3

qdma resv 4 50 50

qdma sch 4 0

qdma rate 4 1 15360 1 51200

qdma m2q 21 4

qdma resv 5 50 50

qdma sch 5 0

qdma rate 5 1 20480 1 51200

qdma m2q 51 5

Four different
minimum rate=>
four different priority

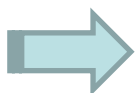
HW QoS (QDMA) replace SPQ

- QDMA replace SPQ (TC function)

QDMA **strict priority** Example

qdma rate 2 0 0 0 0

qdma rate 3 0 0 0 0



Queue 3 priority > Queue 2 priority

QoS Setup	
Quality of Service	Upload to Internet
Upload Bandwidth:	50M Bits/sec
Download Bandwidth:	50M Bits/sec
QoS Model:	SPQ
Reserved bandwidth:	0% (10% is recommended)
QoS Upload Group Settings	
Highest	
High	
Default	
Low	
<input type="button" value="Submit"/>	

HW QoS (QDMA) replace SPQ

```
qdma sch_rate 0 1 51200  
qdma sch 2 0  
qdma rate 2 0 0 0 0  
qdma m2q 11 2
```

```
qdma sch 3 0  
qdma rate 3 0 0 0 0  
qdma m2q 61 3
```

```
qdma sch 4 0  
qdma rate 4 0 0 0 0  
qdma m2q 21 4
```

```
qdma sch 5 0  
qdma rate 5 0 0 0 0  
qdma m2q 61 5
```

Highest: Queue 5
High: Queue 4
Default: Queue 3
Low: Queue 2

HW QoS (QDMA) replace Mixed mode

```
qdma sch_rate 1 1 51200 (total BW=50M)
qdma resv 10 50 50
qdma sch 10 1
qdma rate 10 1 5120 1 51200 (Queue 10=total BW*10%=5M)
qdma m2q 12 10
```

Highest: Queue 13
High: Queue 12
Default: Queue 11
Low: Queue 10

```
qdma resv 11 50 50
qdma sch 11 1
qdma rate 11 1 10240 1 51200 (Queue 11=total BW*20%=10M)
qdma m2q 62 11
```

```
qdma resv 12 40 40
qdma sch 12 1
qdma rate 12 0 0 0 0 (Strict Priority)
qdma m2q 22 12
```

```
qdma resv 13 50 50
qdma sch 13 1
qdma rate 13 0 0 0 0 (Strict Priority)
qdma m2q 52 13
```

QoS Setup	
Quality of Service	Download from Internet ▾
Upload Bandwidth:	50M ▾ Bits/sec
Download Bandwidth:	50M ▾ Bits/sec
QoS Model:	SPQ+DRR ▾
Reserved bandwidth:	0% ▾ (10% is recommended)
QoS Download Group Settings	
Highest	
High	
Default	Rate: 20% ▾ Ceil: 100% ▾
Low	Rate: 10% ▾ Ceil: 100% ▾

Outline

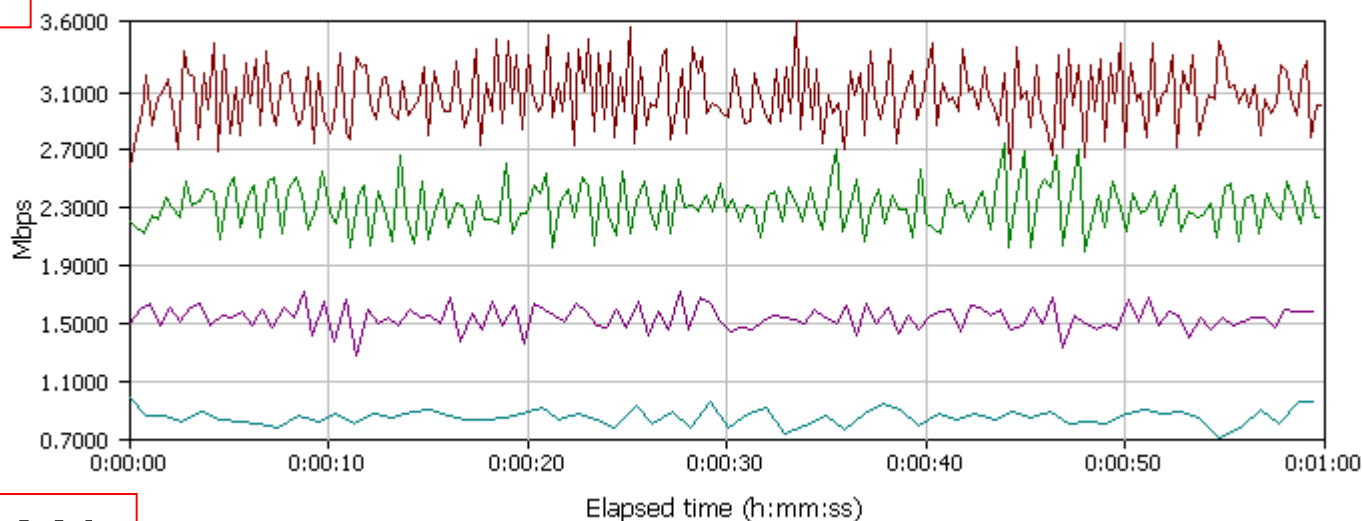
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Test Result (1)

- Test Condition
 - QoS Mode:DRR
 - Total BW = 10M
 - DUT : MT7621 FPGA (QDMA V.S TC)

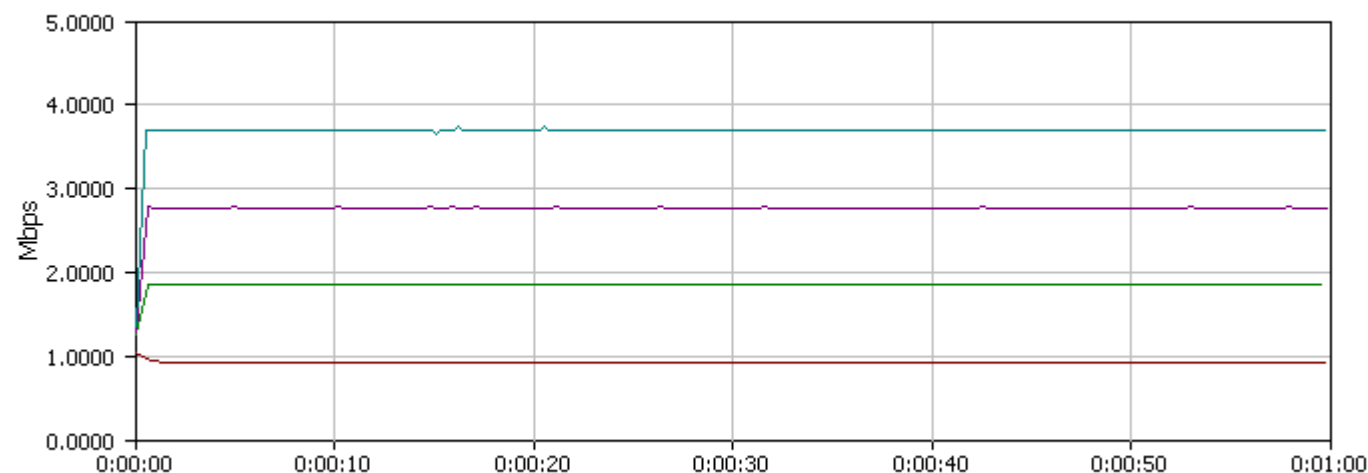
Test Result (MT7621 FPGA) : TCP

TCThroughput



QDMA

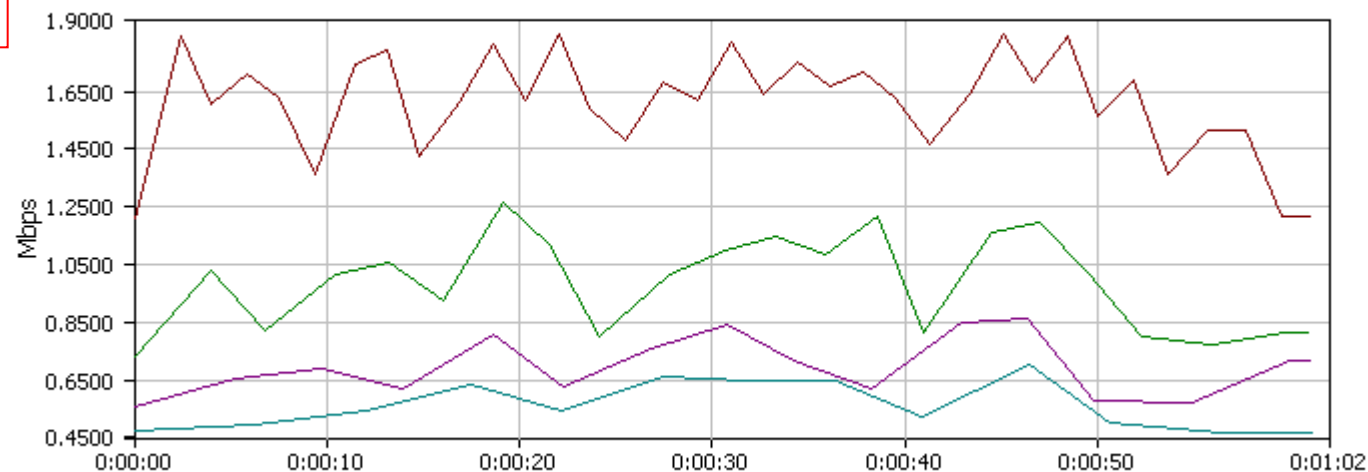
Throughput



Test Result (MT7621 FPGA) : UDP

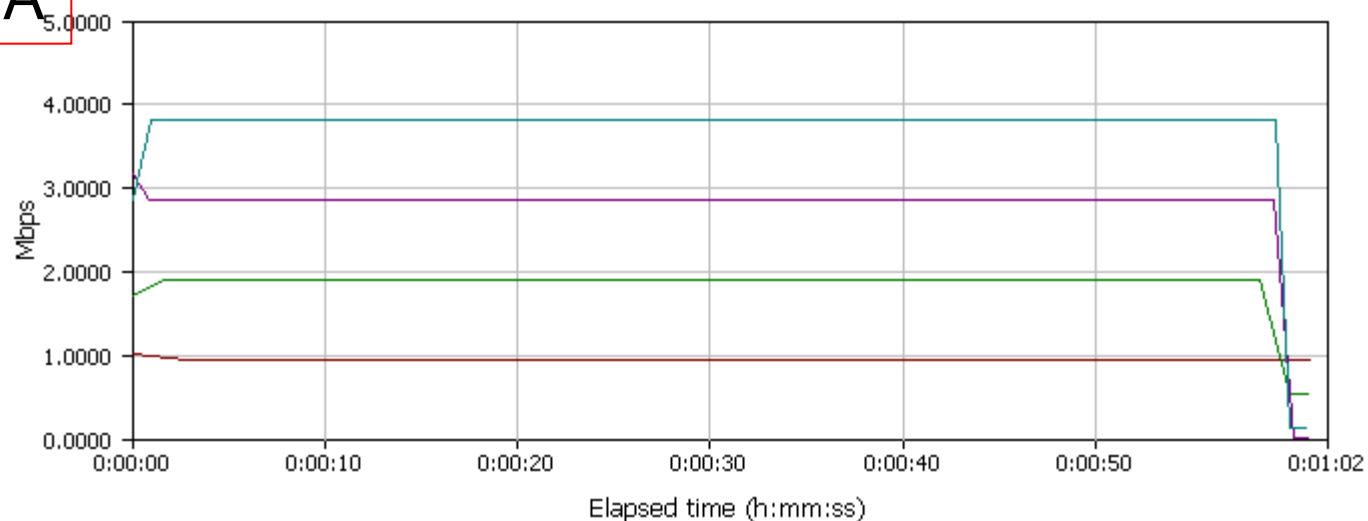
TC

Throughput



QDMA

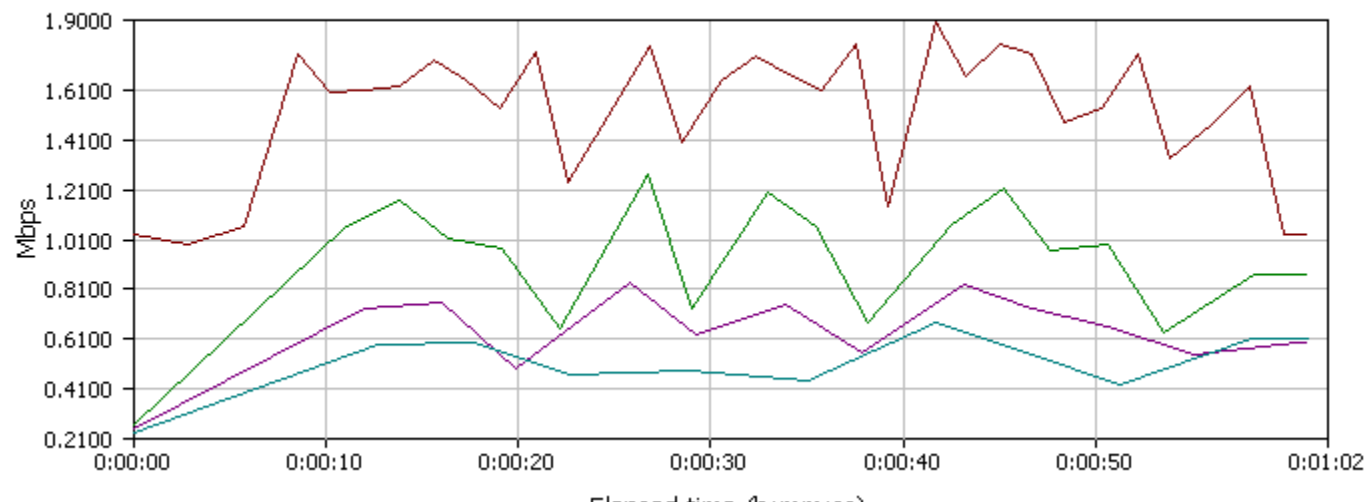
Throughput



Test Result (MT7621 FPGA) : RTP

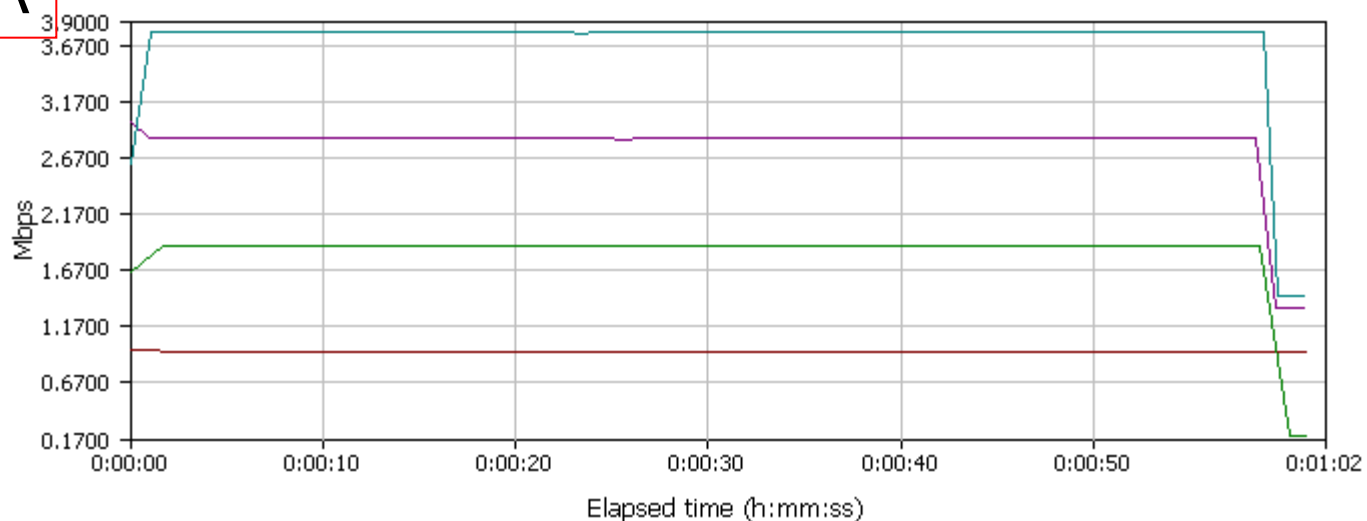
TC

Throughput



QDMA

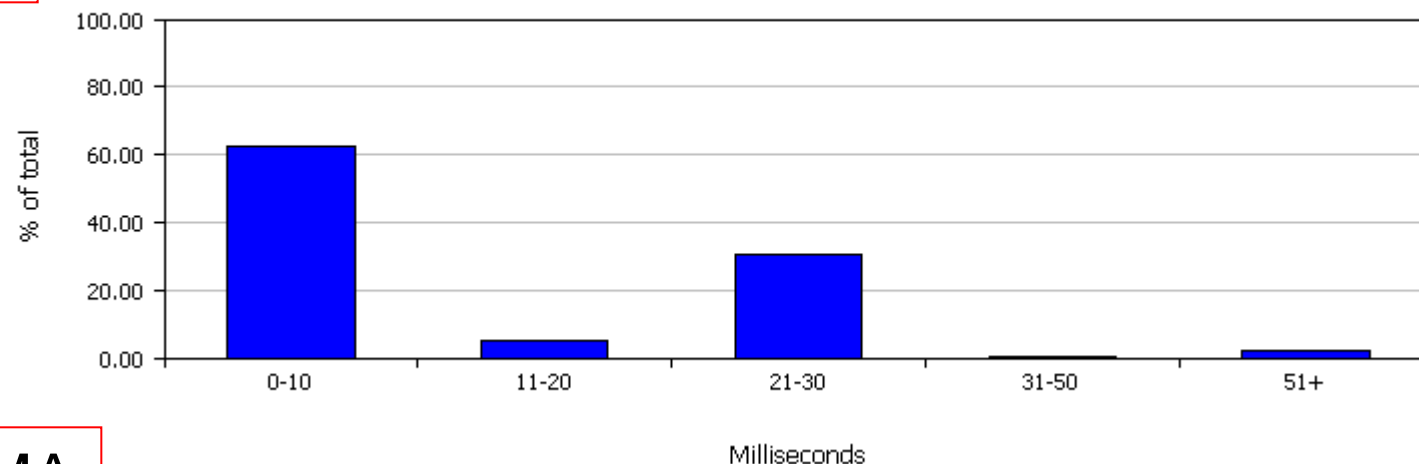
Throughput



Test Result (MT7621 FPGA) : RTP

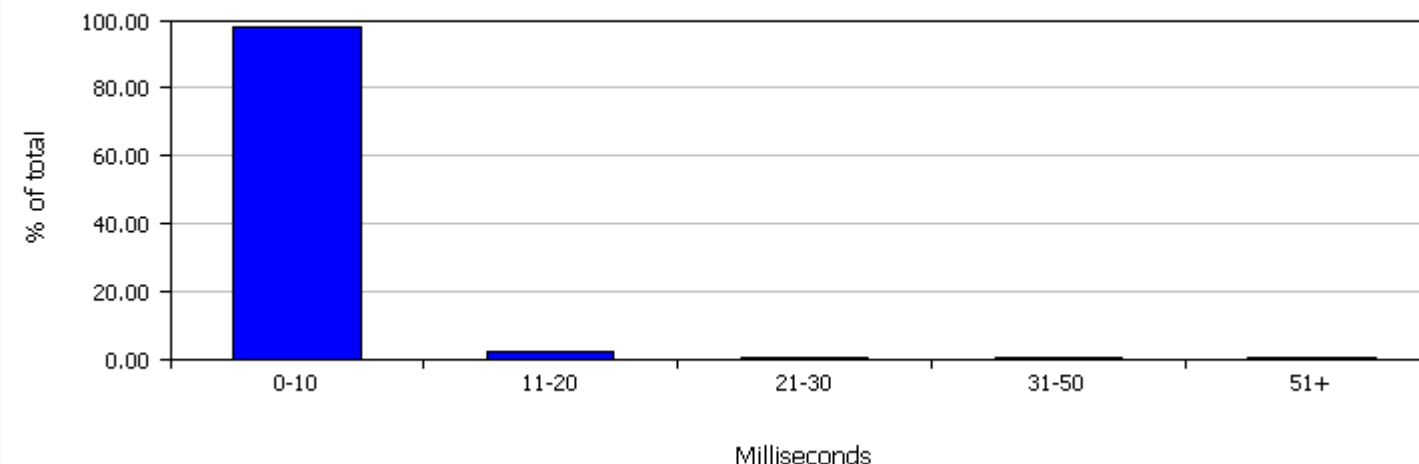
TC

Jitter (delay variation) histogram of timing records



QDMA

Jitter (delay variation) histogram of timing records



QDMA V.S TC (MT7621 FPGA)

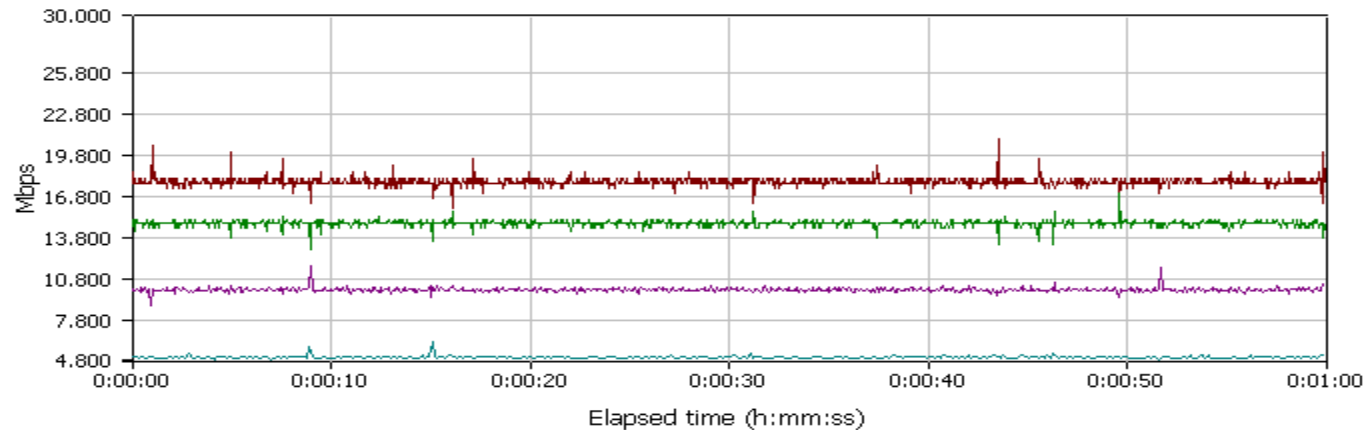
- QDMA can lower CPU loading.
- QDMA can control total BW precisely especially when CPU is busy or computing power is low.
- QDMA can short the response time and jitter.
- QDMA can make transmission rate become more smooth and stable.

Test Result (2)

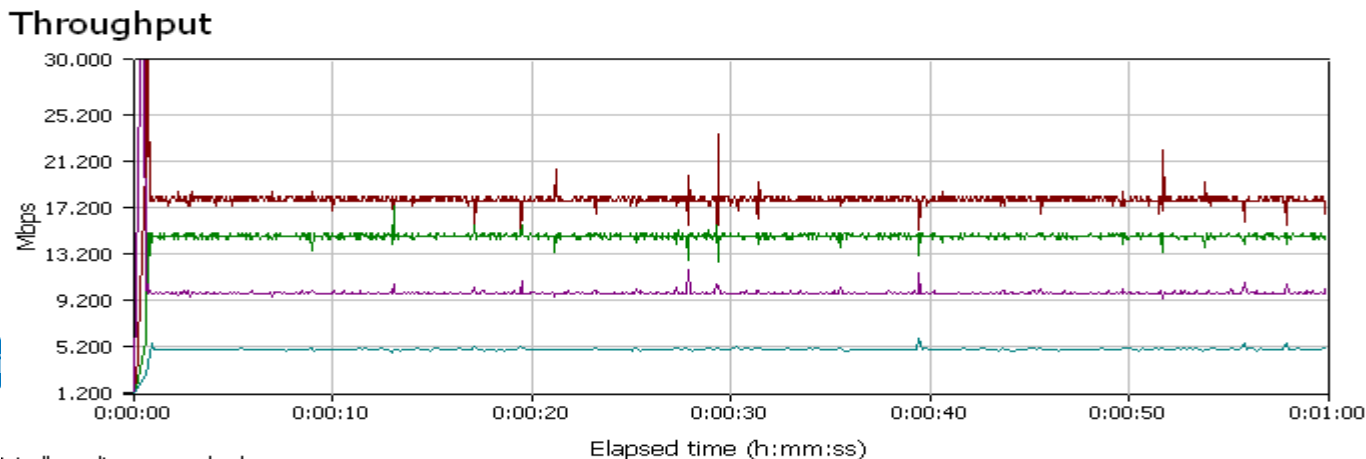
- Test Condition
 - QoS Mode:DRR, SPQ
 - Total BW = 50M
 - DUT : MT7621 ASIC(QDMA **HW NAT** V.S QDMA **no HW NAT**)

MT7621 ASIC (CPU800M) : DRR

- UL(No HWNAT)(TCP port 2000, 3000, 4000, 5000)(Priority High-> Low)
Throughput

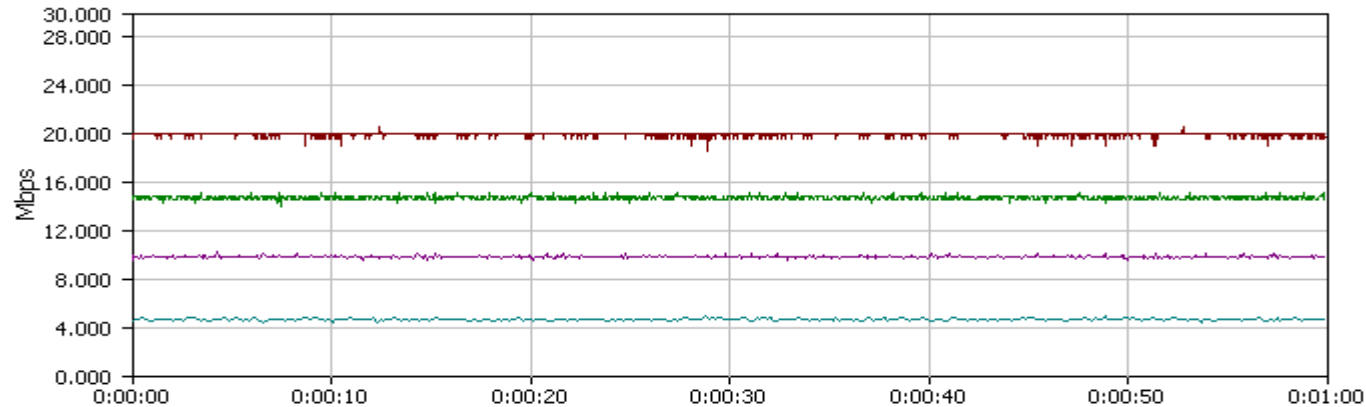


- UL(HWNAT)(TCP port 2000, 3000, 4000, 5000)(Priority High-> Low)
Throughput

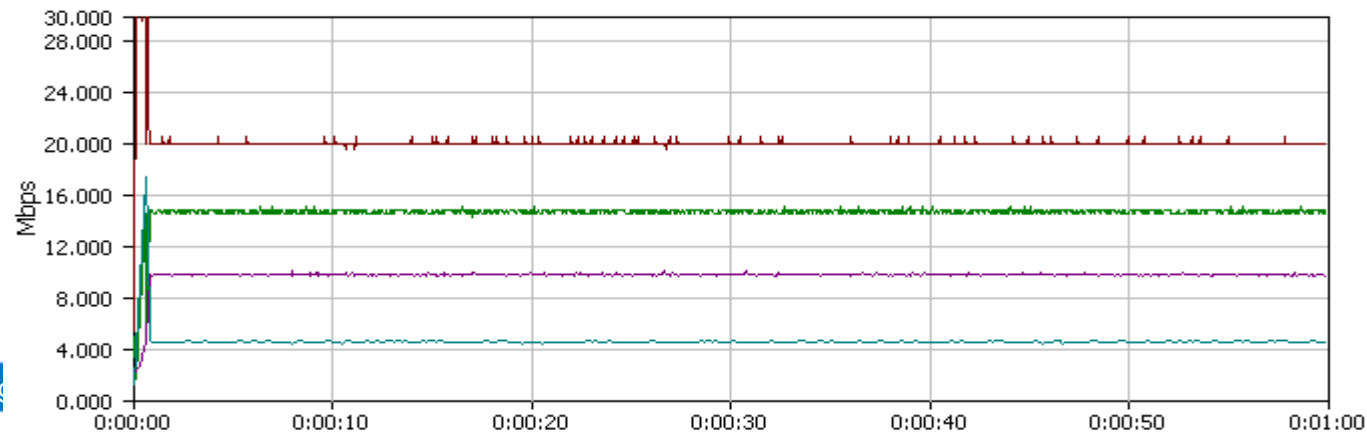


MT7621 ASIC (CPU800M) : DRR

- DL(No HWNAT)(TCP port 2000, 3000, 4000, 5000)(Priority High-> Low)
Throughput



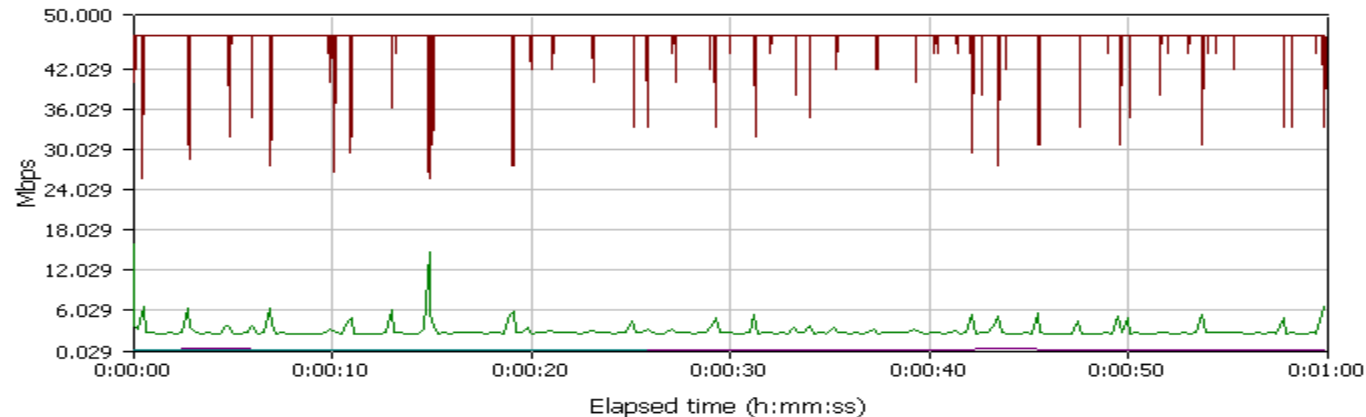
- DL(HWNAT)(TCP port 2000, 3000, 4000, 5000)(Priority High-> Low)
Throughput



MT7621 ASIC (CPU800M) : SPQ

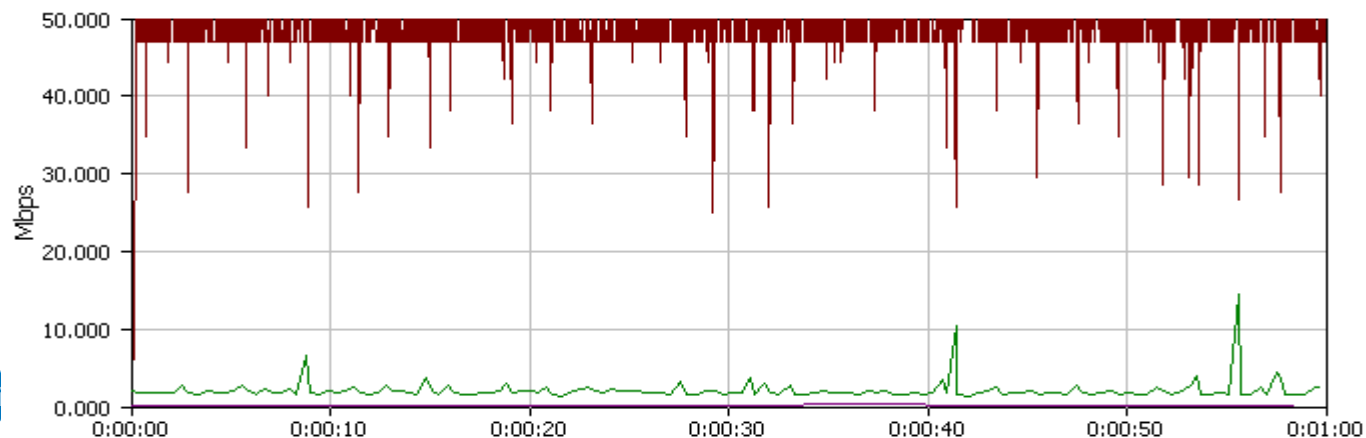
- UL(No HWNAT)(TCP port 2000, 3000, 4000, 5000)(Priority High-> Low)

Throughput



- UL(HWNAT)(TCP port 2000, 3000, 4000, 5000)(Priority High-> Low)

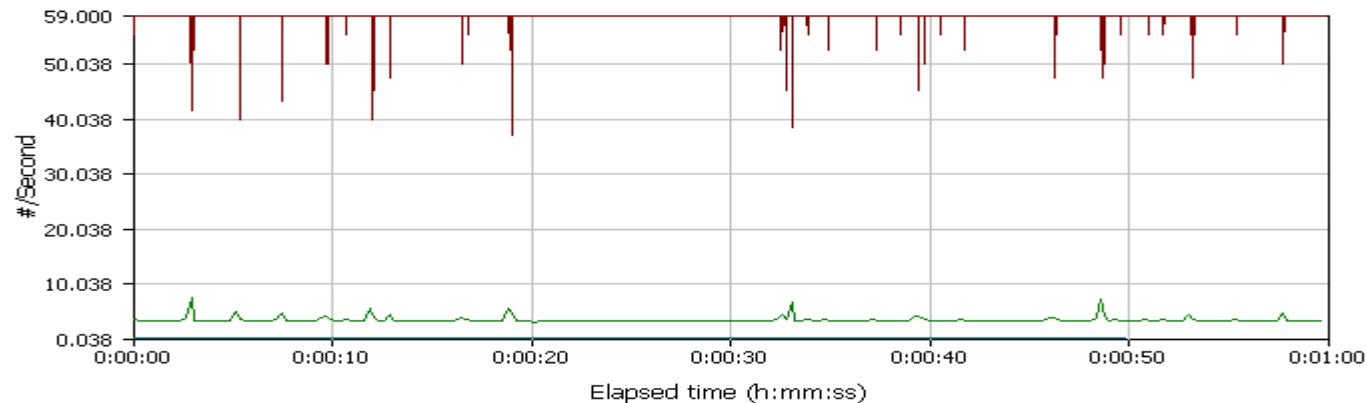
Throughput



MT7621 ASIC (CPU800M) : SPQ

- DL(No HWNAT)(TCP port 2000, 3000, 4000, 5000)(Priority High-> Low)

Transaction rate



- DL(HWNAT)(TCP port 2000, 3000, 4000, 5000)(Priority High-> Low)

Throughput



QDMA Benefit

- QDMA can lower CPU loading.
- In the past, when HW NAT enable, we can not use SW QoS.
- In MT7621, QDMA can do bandwidth control and scheduler when HW NAT enable.

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